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Laparoscopic Approach for Islet Cell Transplantation

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ISLET transplantation has received increasing attention since the recent reports of prolonged insulin independence following human islet allotransplantation.[1] In most of the cases, the islets have been implanted through a laparotomy. We have now explored the laparoscopic approach for implantation of purified islets.

MATERIALS AND METHODS

Subtotal pancreatectomy with preservation of the duodenum was performed in two mongrel dogs weighing 12 and 13.5 kg. The islets were separated by collagenase digestion (Boehringer-Mannheim P, Mannheim, Germany 1.5 mg/mL) using the automated method and purified on Eurocollins-Ficoll discontinuous gradients.[2] The final preparation comprised approximately 291,000 and 146,000 islets with an average diameter of 150 μm. Purity was greater than 90% (dithizone stain). After 48 hours of in vitro culture at 37°C (5% carbon dioxide in air), the purified islets were implanted.

After establishing a pneumoperitoneum with a Veress needle to 12 mm Hg, three laparoscopic ports were used. A 10-mm trocar was placed at the umbilicus for the laparoscope and video camera and two 5-mm trocars were then placed, one each in the left upper and lower quadrants. These allowed instruments to be inserted for retraction, dissection, and implantation.

The purified islets were autotransplanted beneath the serosal surface of the kidney in one case and in the spleen parenchyma in a second dog, using a polyethylene catheter (PE-50) placed under direct vision in both animals. The animals were killed 1 and 3 weeks after transplantation for morphologic confirmation of the islet grafts. For this purpose, the tissue at the transplant site was fixed in formalin and stained for hematoxylin-eosin and insulin (immunoperoxidase).

RESULTS AND DISCUSSION

The laparoscopic procedure was uneventful in both cases and histologic study of the transplanted islets revealed insulin-producing cells. A significant fibrogenic reaction was observed. This may be relevant for long-term function of islets transplanted in the renal site. During laparoscopic inspection of the abdominal cavity, different sites appeared to be easily accessible by this procedure. These included the spleen, the liver, the omentum, and the pancreas.

Laparoscopic surgery has shown advantages to open surgery, including decreased hospitalization, less postoperative discomfort, and improved cosmesis.[3] Widespread acceptance of this procedure has paralleled an expansion of its indications. Islet auto and allotransplantation has been introduced clinically to treat patients with pancreatectomy-induced and type I diabetes.[1] One of the advantages of the procedure is the ease of the implantation that in most cases is a simple infusion into the portal system. Intrahepatic islet transplantation does not require a laparoscopic approach, since a percutaneous catheterization of the portal vein has been described. In addition, the umbilical vein can be recanalized under local anesthesia and used as a port for intraportal islet infusion. Recent experimental evidence has led investigators to question the liver as an appropriate site for islet transplantation in large animals.[1] Laparoscopic surgery could be useful to transplant islets or other cell types in alternative intraabdominal sites. In addition, a laparoscopic approach could be appropriate in cases in which multiple donors are used at different times to achieve complete metabolic correction to avoid relaparotomy.

In summary, the present study indicates that laparoscopic surgery can be safely used for islet transplantation and may be applicable for other cell transplant procedures.

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